

# The development of the adult female lac cell

## (Hom. Sternorrhyncha)

BY

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(Láms. IV-VII.)

Scale-insects, being injurious to plant life, have been studied with a view to eliminate them. Lac, being a useful product, coccids producing it, are artificially propagated and an entomologist working on them has therefore to study them thoroughly. One problem, in lac cultivation is to determine, as quickly as possible, the stage of growth in which a colony of insects may be found. A low power magnification, under a dissecting binocular microscope, often suffices for the purpose. What has been done on this special problem is quite incidental. The life-cycle of any scale-insect can be broadly divided between its larval stages as one and the adult stage as the other. To distinguish among different larval stages, up to the last moult, enough has been published. Even here it was not certain, at first, if the female insect undergoes two or three moults. For example, according to Negi<sup>1</sup>, the female lac insect becomes adult in its third stage, whereas an article in this journal<sup>2</sup> has established that, the female moults thrice, and it is the fourth stage that represents the adult. Further the developing adult female has hitherto been characterized merely according to its age. Now there are two life cycles of the lac insect in North India, roughly one of 4 months and the other of 8; therefore to state that the insect was 2 or 3 months old, without further particulars, means next to nothing. Information required for deciding how a colony of lac insects is developing after fertilization has to be more definite which is being supplied by the present communication.

<sup>1</sup> P. S. Negi: A contribution to the life history of the lac insect. *Bull. Ent. Res.*, 1929, **19**: 327-341.

<sup>2</sup> S. Mahdihassan: The third stage larva of the female lac insect. *Eos*, 1932, **8**: 11-28.

To actually present a problem, fig. 1 is offered as a particular colony of *Lakshadia communis* on *Guazuma tomentosa* seen early in August, at Bangalore, India. The larvae are covered by their secretion of lac resin which is what we actually seen. The two cells, marked no. 1, represent male and female larvae; both are further enlarged in fig. 2. The larger and longer cell belongs to the winged male. The Opercular lid, through which the adult male will escape, is clearly formed and marked O, showing that its second moult has occurred, and the insect within is now in its prepupal stage. The first stage larva is protected by a dorsal shield of hard wax. This shield can be subdivided into an anterior region, having two plates or segments, 1 and 2; an intermediate portion, of segments 3 to 7; and lastly a posterior unit, comprising of segments 8 to 11. This dorsal wax-shield continues to remain incorporated as a relic on the surface of the growing cell but the original segments get displaced in response to subsequent growth. Segments 1 and 7 of this dorsal shield have been previously (2) shown and marked as d 1 and d 2, in fig. 14, as vestige of the first stage cell and persisting on the cells of later stages. In fig. 2 here, is seen the rib like segment no. 7, of the original first stage larval wax-shield which as a whole now looks somewhat like a backbone on both the cells. The wax-shield of first stage larvae, on being retained as such, is very insignificant in size on the back of an adult female cell. The larger or the male cell, in fig. 2, shows five rib like segments of the middle region of the wax-shield and of all segments the most posterior is marked no. 7. Segment no. 3 is the most anterior among the segments of the central portion but has not been marked. The anterior segments are only two, which can be clearly seen even though they have not been indicated. Shield segment, no. 2, has, on each side, a tuft of white threads which represent curled filaments of soft-wax. The regions from which this soft wax exudes is special to lac insects. Beneath each of the two tufts is a porous chitinous plate, which represents fused ducts of wax secreting glands. This structure is called Brachium, hence the corresponding spot on the outside of the cell is also marked "B" in fig. 2. This indicates the left Brachial spot, the one to the right not being marked, but a tuft of similar wax threads reveals the other. Focussing out attention on what may be called the *backbone* of the male cell, in fig. 2, we see as a relic the dorsal shield, with its anterior region, comprising of shield segments 1 and 2, not marked, but of which segment 2 has the two Brachial openings "B" on each side.

The middle region of the backbone comprises of segments ending posteriorly with no. 7, which is indicated, and anteriorly with no. 3, not marked. Between segments no. 3, of the middle region, and no. 2, of the anterior region, there is a wide gap, produced as an external expression of a lengthwise growth of the male larva within the cell. The posterior region comprises of shield segments 8 to 11. These form a triangular piece on the dark Opercular lid, O, fig. 2. Let us now compare the female cell which is close enough to the male to suggest that both were of the same age. Its second moult-skin, M., is about to be thrown off, so that the larva now is in its early 3rd stage, marked III, fig. 2. A glance on the old dorsal wax shield shows only segment 7, being marked. The anterior and middle batches of shield segments form one continuous unit, from segment no. 7 to no. 1, seven of them being counted. This intact shield on the female cell, III, forms a contrast with that of the disarranged segments on the male cell near it. The male cell grows lengthwise, the female cell grows upwards or perpendicular to the surface of the twig. Since the female does not grow lengthwise the original dorsal shield is not stretched so much and remains relatively intact on the surface of female cell, III.

We may refer again to the wax filaments at the spot marked "B", on the male cell in fig. 2. The corresponding Brachial opening, but of the right side, in the female cell, III, shows merely a white streak but no wax threads. The female larva, III, has just moulted, so that its present cell has been really constructed by the 2nd stage larva. The growth of the male has been vigorous in its second larval stage and its cell is fully formed during this period. Its later stages, comprising of prepupal and pupal stages, do not require any further expansion or construction of the cell for the insect within merely undergoes further metamorphosis. The cell of the second stage female larva does not represent the period of its maximum growth. Restating the above facts in simpler language we can say that, in its second stage the male builds its cell to the fullest extant, whereas the female in its second stage still behaves like an immature larva. The wax filaments, seen on the male cell, at B, fig. 2, are formed by the second stage male larva at its most energetic period of life, whereas a corresponding region in the female cell, III, shows only a white streak as a relatively poor physiological activity. Fig. 2 shows how easy it is to distinguish the male and female larvae when both are at the end of their second larval stages.

The pair of cells, numbered 2, fig. 1, have been enlarged in fig. 3.

In fig. 3 we find the female cell, II, still in its second larval stage, its second ecdysis has not occurred as yet. The dorsal wax shield, as a whole, can be seen equally well on the younger cell II, fig. 3, as on cell III, fig. 2. The female cell, in fig. 3, is close to the male cell and their cell-walls are partly fused with each other. These two insects, probably of the same age, are however in different stages of development. It is this point that has not been considered by previous workers and requires being pointed out by actually presenting a concrete case. The male cell, in fig. 3, belongs to the wingless male, while that in fig. 2 represents the winged male. The dorsal wax shield, on the back of wingless male cell, shows anteriorly, segments 1 and 2, as joined together. This piece is separated by the middle region constituting three segments 3 to 5, then there is separation again followed by two segments 6 and 7. Here follows a wide gap until we reach the circular flat area of the opercular lid. This lid terminates with the posterior end showing on its surface shield segments 8 to 11. The fully formed cell of the wingless male, in fig. 3, is smaller in length than that of the winged male in fig. 3. If we consider the old wax shield, seen as a relic on the back of male and female cells in fig. 3, we realize the lengthwise expansion of the male larva at once. By contrast the female does not reveal such a growth in length. The female grows in height as also in girth, acquiring in the end a pear-shaped body; its cell, in the 3rd stage, is seen as III, fig. 3. The old wax shield, shaped like a fish, shows a continuity among its segments 1 to 7, both inclusive. Between segments 7 to 8, both of which are marked, there is a slight separation, then follow segments 8 to 11 as one triangular piece. The surface of the female cell, III, shows three white spots, two in front, more prominent, representing Brachial openings, associated with the major spiracles; at the posterior extremity, beyond segment no. 8, which is marked, lies the Anal Opening. The Brachial openings have wax filaments, the Anal opening has a tuft of Anal Ring Hairs but no wax threads. The Anal Opening is surrounded by a ring of 10 Anal Ring Hairs. In III, fig. 3, the Anal Opening is seen like a dark spot, with a white circle of Anal Ring Hairs. These hairs are covered by a soft wax which is secreted from wax glands associated with each hair. The 3rd stage female cell is seen at its earliest stage as III, in fig. 2, and fully formed as III, in fig. 3. When third or last moult of the female occurs the young adult acquires a dorsal spine, a characteristic of lac

insects. The earliest adult female cell is seen in fig. 4. This cell has really been formed by the third stage larva for the female has just started its life as adult and has had no time to contribute to the architecture of the cell which it now occupies.

The cell is a structure of resin supported on an inner frame-work of hard wax. This wax is secreted from 6 patches of glands around the circumference of the body. When covered over by lac resin was appears like projections or supports aroud the outer cell margin. Three such projections on one side are marked 1, 2 and 3 in fig. 4. A little later, hardly a week after, another insect was drawn showing a three-fourth view of the cell, fig. 5. Even this has been reproduced before (2) but is being offered to explain how the adult female gradually enlarges its cell. The inner skeleton of hard wax, covered over with the layer of lac resin, is revealed indirectly as three pairs of columns indicated as 1, 2 and 3, in fig. 5, comparable with those marked likewise in fig. 4. The anterior dorsal surface, in fig. 5, shows a pair of Brachial openings, one being marked, B. Between the two Brachial openings and crossing them at right angles lies the fish-shaped wax shield, the relic of the first stage larval cell. Here we can see the two anterior shield segments, 1 and 2, and in continuation five other segments of the central region, appearing somewhat like a raised backbone. The last segment of the middle piece should be understood as no. 7 (here consult no. 7, fig. 3). Then follow segments of the posterior region of which 8 to 10 are clearly seen, though not marked, while no. 11 is not visible at all. Between the shield segments 7 and 8 (consult fig. 3 for the markings) lies a spine, absent in III, fig. 3, but evident in the adult cell, fig. 5. The fully formed dorsal spine characterizes the adult stage of the female and explains its absence in cell III, fig. 3, which still belongs to a larva. The Spine fixes the soft bag-like body of the lac insect into the ceiling of its cell. The roof of the cell is pushed upwards from below by the frame work of hard wax which is secreted from glands on the basal region of the body. Pushed from below the cell grows vertically and pulls the body of the insect upwards as the cell roof is elevated gradually. The posterior region shows the Anal aperture, A., of the cell, in fig. 5. Normally this aperture is occupied by a bunch of ten Anal Ring Hairs, already seen in cell III, fig. 3. In fig. 1 cell no. 3 has not moulted for the last time, while cell no. 4 is already a young adult, like, fig. 5.

The insects shown, in figs. 1 to 5, both inclusive, pertain to *Lakshadia*

*communis*. Fig. 6, on the other hand, belongs to *Lakshadia mysorensis*, found solely on *Shorea talura*. Fig. 6 represents a later stage than the cell in fig. 5. The dark hole at the posterior extremity, in fig. 6, is the Anal Opening. In front of it lies the Dorsal Spine projecting out of the roof which, at this stage, is not thick enough to cover the spine. Immediately anterior to the spine is the fish-shaped dorsal wax shield, the legacy left by the first stage larva. Proceeding from the spine towards the anterior end we can count the shield segments in their descending order, 7 to 3, all forming one piece. The anterior region of the shield has only two segments, nos. 2 and 1, but segment no. 2 got split and we see three instead, while originally there were only two. At the circumference of the cell there is a creek pointing inwards or towards the cell. If we project this creek further in imagination we find it points to a crater-like aperture on the back of the lac cell. There are two such openings on the dorsal surface, on either side of the fish-like wax shield. These are Brachial openings (consult B., fig. 5). The line connecting the apex of the creek below, with the left Brachial aperture above, corresponds in structure with the white line on the front region of the female cell, III, fig. 2. Even in early adult life of the female the Brachial plate remains on the dorsum while immediately below it, and on each side of the body, a Major Spiracle is situated. In continuation, towards the ventral side, is a long row of wax secreting pores, the Prestigmatic pores, in common with other scale insects. They form a long line and secrete soft wax inside the cell of the adult female but outside the larval cell, III, fig. 2. Fig. 6 shows a stage later than that of fig. 5 and it must be remembered that the specimens belong to two different species, *L. mysorensis* and *L. communis* respectively.

Fig. 7, shows the young adult cell of *L. mysorensis*, more advanced than fig. 6. The Anal Opening is evident as a dark hole. In front is the black spine projecting above the roof of the cell. The relic wax-shield has expanded side ways and most of its segments have become indistinct. There are two crater like openings or Brachial openings on the dorsal surface of the cell, fig. 7, on either side of the old wax-shield, now looking like a backbone. The Brachial opening on the right side shows a white narrow streak pointing downwards, identical in structure to the conspicuous white streak of cell III, fig. 2. In fact in both cases the white streak is the wax secreted by the parastigmatic pores below the major spiracle. The corresponding region on the left side of the

cell, fig. 7, is seen like a dark valley or grove, the Parastigmatic Grove, P. G. The dorsal surface of the cell shows globular projections, which are the relics of the 3rd stage cell, and accordingly marked III, in fig. 7. These globules were once the projections marked 1, 2 and 3 in fig. 5. In the cell, fig. 7, they have been lifted above and the elevation is clearly revealed in the picture. The dorsal globules, III, in fig. 7, are spherical which is the case whith *L. mysorensis*, the corresponding feature in the species *L. communis* would be oval. When cells of these two species are critically examined it is possible to differentiate them by this feature at the end of the 3rd larval stage, or before the insect becomes a young adult female. In fig. 8 the cell has expanded in its circumference; for the insect body has become broader, and consequently the dorsal globules, III, in fig. 8, have been stretched and flattened which does not impart the same prominence as originally found and marked III, in fig. 7. The young adult cell is now showing its own activity and globules of lac marked 1, 2 and 3, at the base of the cell, fig. 8, are seen as exudation products. The parastigmatic pores are secreting white wax within the cell, and through the transparent coat of lac-resin wax is seen as a line in the Parastigmatic Grove, P. G. The dorsal Spine is also prominent and marked Sp., in fig. 8. There are 10 Anal Ring Hairs, A. R. H., of which 5, of one side, are shown. The actual body of a young adult female insect, at the stage when its cell compares with that of fig. 8, is presented in two positions in fig. 9. Whereas the cell in fig. 8 belongs to *L. mysorensis* the insect, in fig. 9, belongs to *L. communis*. Seen dorsally the picture to our left shows the parastigmatic grove, P. G., on both sides. This has to be compared with P. G., of fig. 8. The circumference of the left insect is marked at three spots as 1, 2 and 3. These represent the areas from where the globules of lac finally exude and compare with 1, 2, and 3, marked in fig. 8. The dorsal surface shows muscle joints, M., there being also others but not indicated. The Anal Tubercl, ending in 10 Anal Ring Hairs, is self evident, which has been actually indicated as A. R. H. in the same insect titled and placed to our right in fig. 9. In front of the Anal Tubercl bearing the Anal Rir:g Hairs is the spine, on a dome shaped tubercle, the Spinoid Tubercl. This is seen better in profile in the picture to our right. The left picture shows anteriorly, on the dorsal surface, two horse-shoe shaped objects. They are the actual Brachia or Brachial Plates, B. P., marked on the picture to our right. In the latter picture the region marked 3 shows the insect's girdle or

equatorial region and in particular one spot where a patch of pores are situated and from where a ribbon of hard wax pencils arises. There are 6 such patches of pores all around the girth of the insect body, 3 on one side being marked in the picture to our left, but only the 3rd in that to our right. The exudation of lac flows along the hard wax which forms an inner frame work of the cell. The lac appears as globules outside the cell, the wax pencils remaining hidden and close to the insect body. The markings 1, 2 and 3, in fig. 9, show the areas from where the hard wax pencils arise. In fig. 8, we see the globules of lac outside each area of origin.

A later stage than fig. 8 is shown in fig. 10 which however belongs to *L. communis*. The dark Anal Opening is self evident. The Anal Tubercl had been withdrawn within the cell which is now dead. In front are two smaller white spots, the Brachial Openings (compare B. O., fig. 8). Between these three spots lies a fish shaped object, the old wax shield which once covered the body of the first stage larva. The basal circumference of the cell, fig. 10, shows a circular rim of lac exudation. In cell, fig. 8, there are globules of lac from localized regions of secretion; in fig. 10 the secretion is so copious that the product appears as a continuous ring. On the dorsal circumference we also see large globules, the product secreted by the young adult. But we also find elliptical, claw-like objects, absent on the cells of *L. mysorensis* like figs. 6 and 7, but present on the earlier cell of *L. communis*, fig. 5. These elliptical or claw-like objects are wax pencils of 3rd stage larva, covered with lac. They are the same which have been marked 1, 2 and 3 in fig. 5. In fig. 10 they appear as relics of the 3rd stage larval cell. Fig. 11, gives a macrophotograph of a few cells of *L. communis*. Attention may be directed to the main cell, whose circumference is marked by four white arrows. There are three white spots arranged like '...', or the mathematical symbol for "since". The smaller pair have a few delicate wax threads; the spots represent the two Brachial Openings (compare B. O. fig. 8). The third aperture is the largest of them all, and shows the bunch of Anal Ring Hairs (compare A. R. H., fig. 8). The cell which is circumscribed by the four white arrows shows an all round secretion of lac resin like the rim seen in fig. 10; in fig. 11 the rim is thicker depicting a later stage of cell development. Fig. 11 also belongs to *L. communis* so that the drawing, fig. 10, which offers subjective evidence, with a personal factor, gains importance on comparison with fig. 11 which is a macrophotograph.

A much later stage than that shown in fig. 11 but of *L. mysorensis* is revealed in fig. 12, with globules of lac seen to the right and on the basal cell margin, as in fig. 8, and also those pushed upwards, on the left side of the cell, fig. 12, due to the neighbourhood on its left with another cell. The circumference of the cell, to our right, shows three markings, 1, 2 and 3, which are to be compared with similar markings on the cell, fig. 8, where they are also on the basal margin. The dorsal surface of cell, fig. 10, shows elliptical, claw-like, markings, characterizing *L. communis*. The surface of the cell in *L. mysorensis*, fig. 12, shows a relatively clear surface and the absence of these particular relics. A later stage than fig. 12 is shown by the cell of *L. communis*, in fig. 13. The exudation of lac begins from the base, for at the early stage the equatorial or girdal region of the body is close to the surface of the twig. The insect gets elevated from bottom upwards; fig. 13, shows the cell growing from the bottom and being elevated higher and higher. The rim of lac exudation, seen in fig. 10, is far more developed in fig. 13. The dorsal surface shows the dark Anal Aperature, and a dorsal Spine, now partly hidden, but still protruding through the back of the fish-like old wax shield. The dorsal surface anteriorly shows two white spots, the Brachial Openings. Above all there are elliptical claw-like relics of the 3rd stage larval cell, characterizing the species *L. communis* and absent on cell surface in fig. 12, belonging to *L. mysorensis*. We have to contrast the cells figs. 13 and 10 with those of 12, and 9; the former belong to *communis* the latter to *mysorensis*.

On comparing figs. 10, 13 and 14, we see how the insect secretes more and more lac and at the same time that the cell wall is raised from below upwards. The spot marked V, in fig. 14, was once at the base of the cell, but was gradually pushed upwards by the secretion of lac arising from below. The Anal Opening, A. O., the Spine, Sp., and the Brachial Openings, B. O., are all marked in fig. 14. Fig. 15 shows a cell of *L. communis* more developed than that of *L. mysorensis* in fig. 14. The relatively rough surface of fig. 15, with prominent claw-like elliptical protuberances, characterize *communis* and are absent in fig. 14, belonging to *mysorensis*. The circumference of the cell shows an upper layer below which is a basal one. A cell of *L. communis* still further developed is seen in fig. 16. By this time the dorsal spine seen in fig. 14, is no longer apparent which was also the case already in fig. 15. Fig. 16 shows how the cell has grown from bottom upwards, the two layers of the cell wall seen in fig. 15, have become fused into

one, in fig. 16, but even here, the cell is not fully formed. The elliptical vestiges of the 3rd stage larval cell are obvious on the dorsal surface of fig. 16, which are altogether absent on surface of much earlier stages of *L. mysorensis*, figs. 14 and 12. In fig. 11 we see the cell with a rim of lac exudation at its base. In fig. 16 we see the rim has enlarged into circular high wall, and seen from above we find a central, rough surfaced disc, with 3 holes, and a smooth wall as circumscribing the central disc.

We have to particularize a feature which can become important in establishing the stage of the lac insect by examining its cell after its last moult. The young adult begins its life with acquiring a dorsal spine. Its cell reveals on the dorsal surface a protruding Spine, fig. 5. The dorsal surface of the lac cell gets covered with layers of lac resin and the dorsal Spine becomes gradually embedded and hidden from view. The Spine is seen just protruding in cell no. 14, but has disappeared in the stage seen in no. 15. By concentrating attention on the protruding spine we can judge the stage in which the lac cell may be found. This is not the only criterion but the main one which can subdivide the adult female lac cell into two stages, from the last moult to the disappearance of the spine on the dorsal surface, and the subsequent stage when the life cycle ends with the birth of the next generation. This second period can be further subdivided mainly by examining the stages in which the developing eggs are to be found.

#### EXPLANATION OF LAMS. IV-VII

##### LAM. IV.

Fig. 1.—Scattered cells of *L. communis* on *Guazuma tomentosa*, during August, at Bangalore, India. Pair of cells, no. 1, represent cells of winged male and female; no. 2, wingless male, a female in 2nd stage and another in 3rd. Cell no. 3 is female in early 3rd stage; no. 4, ready for last moult.

Fig. 2.—Enlarged pair of cells, no. 1, in fig. 1. The longer cell belongs to winged male, now as prepupa. The Operculum, O., has been formed showing 2nd moult has occurred. From Brachial Openings, B., arise tufts of soft wax threads. The dorsal surface carries as relic an earlier wax shield, of which segment no. 7, is marked. These segments are pulled apart due

to growth in length. The female larva is undergoing 2nd moult, and shows moult skin, M., so that is now in 3rd stage, III. Its old dorsal wax shield is not disrupted and 7th segment, no. 7, remains connected with others.

#### LAM. V.

Fig. 3.—Enlarged group of cells no. 2, in fig. 1. The long cell belongs to wingless male now in prepupal stage within. The female cell has not yet moulted and is in its 2nd stage, II; the third cell is in the late 3rd stage, III.

Fig. 4.—After the 3rd moult, or in the 4th stage, the female becomes adult and its cell acquires a spine dorsally. The cell belongs to *L. communis*.

Fig. 5.—A young adult female cell of *L. communis*. A., Anal Opening; B., Brachial Opening. Hard wax from 3 specialized regions on the sides, exudes as pencils and is covered over with lac resin; 3 such exudations are marked 1, 2, and 3. They persist later as relicts. Note the dorsal Spine.

#### LAM. VI.

Fig. 6.—A young female cell of *L. mysorensis*. The Anal Opening is large and dark. In front is the dorsal Spine, is a white needle. Further still the fish-shaped wax-shield of the first stage larva, here as relic. In front of the wax shield, on either side, as white spots are the Brachial Openings. The cell margin below the Brachial Openings has a creek like projection marking the anterior region of the body.

Fig. 7.—A female cell of *L. mysorensis* further advanced. The "creek" in fig. 6 is the Parastigmatic Grove, P. G. Along narrow passage on the skin of the insect, lie the Parastigmatic Pores secreting wax. The dorsal surface shows the dark Anal Opening. In front is the dorsal Spine. Then a pair of white Brachial Openings in line with the Parastigmatic Groves. The relict of 3rd stage larval cell, is marked III, being the objects marked 1, 2, 3, in fig. 5. Note how the cell has been raised from below upwards.

Fig. 8.—Female cell of *L. mysorensis*. The Anal Ring Hairs, A. R. H., projecting from the Anal Opening. The dorsal Spine,

Sp. is a dark needle. Brachial Openings, B. O., appear white due to soft wax which is secreted here. The relics of 3rd stage III, are objects identical to 1, 2, 3, shown in fig. 5. The Parastigmatic Grove, P. G., corresponds with the same marking in fig. 7. Fig. 8, as a later stage than fig. 7, shows more exudation of lac, marked 1, 2, and 3, being the same regions marked likewise in fig. 5.

Fig. 9.—Cells of *L. communis* of the same age as the cells of fig. 8, with which fig. 9 has to be compared. The Anal Ring Hairs, A. R. H., is borne by the Anal Tuberle which occupies the Anal Aperture. The two Brachial Plates, B. P., occupy the Brachial Openings of the cell. The insect body is fixed into the ceiling of the cell by the Spine borne on the dome shaped Spinoid Tuberle. The anterior margin of the cell shows the Parastigmatic Grove, P. G., and three areas from where hard wax exudes carrying with them a good deal of lac exudation. These areas are marked 1, 2, 3 to be compared with the same indications in fig. 8. Muscles joining the dorsal skin with the ventral one are also present; M., marks muscle joint.

Fig. 10.—*L. communis*, cell, showing on the margin, a rim of lac exudation. The dorsal surface shows the fish-shaped wax shield as legacy of the first stage. Note on the dorsal circumference spherical protuberances and minor claw-like.

#### LAM. VII.

Fig. 11.—*L. communis*, the cell pointed by four white arrows depicts a stage similar but more advanced than that of fig. 10. There are three white spots, the smaller pair are Brachial Openings, the largest is the Anal Aperture. Note the rim of lac exudation around the cell.

Fig. 12.—*L. mysorensis*, showing fresh exudation of lac as spherical globules. Those on the right, originating from three regions have been marked, to be compared with regions on the skin marked 1, 2 and 3 in fig. 9.

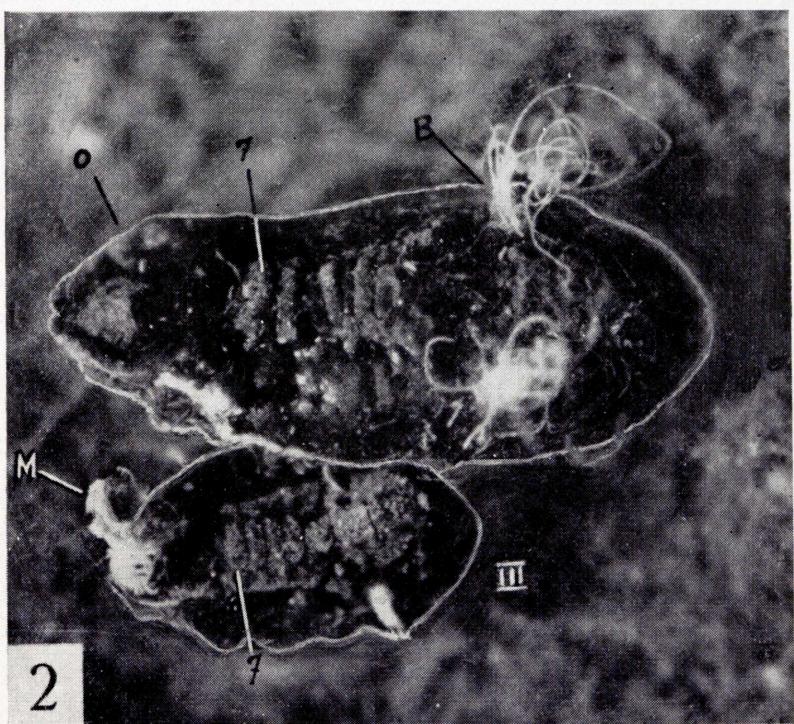
Fig. 13.—*L. communis* cell with a clear rim of lac exudation at the bottom of the cell. Note the claw-like protuberances on the dorsal surface, being relics of 3rd stage larval cell.

Fig. 14.—*L. mysorensis*. The lac cell grows from base upwards. The former ventral rim of lac, V, is now raised high up. A. O. is Anal Opening; Sp. is the dorsal Spine, partly embedded within the layer of lac. B. O., is Brachial Opening.

Fig. 15.—*L. communis*, a cell on *Pithecolobium dulce*, Hyderabad Decan, India. The growing cell, being lifted from below shows two layers of the circular wall. Its rough dorsal surface, with claw-like projections, is typical of *L. communis*. The dorsal spine is fully embedded within the lac secretion.

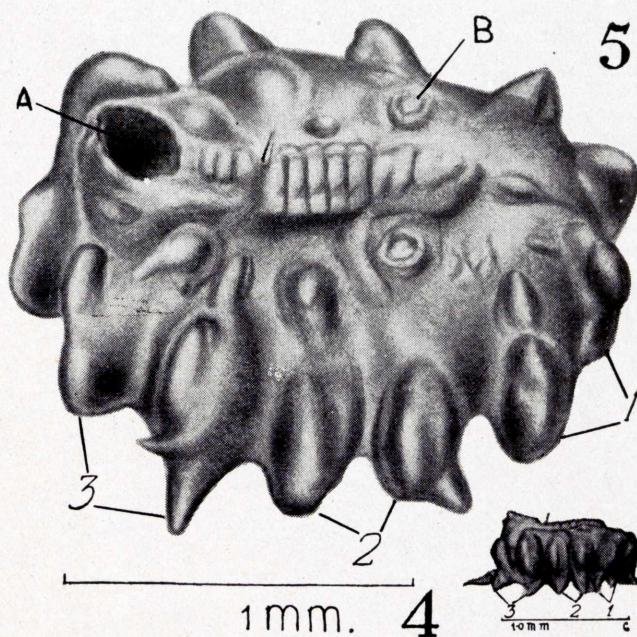
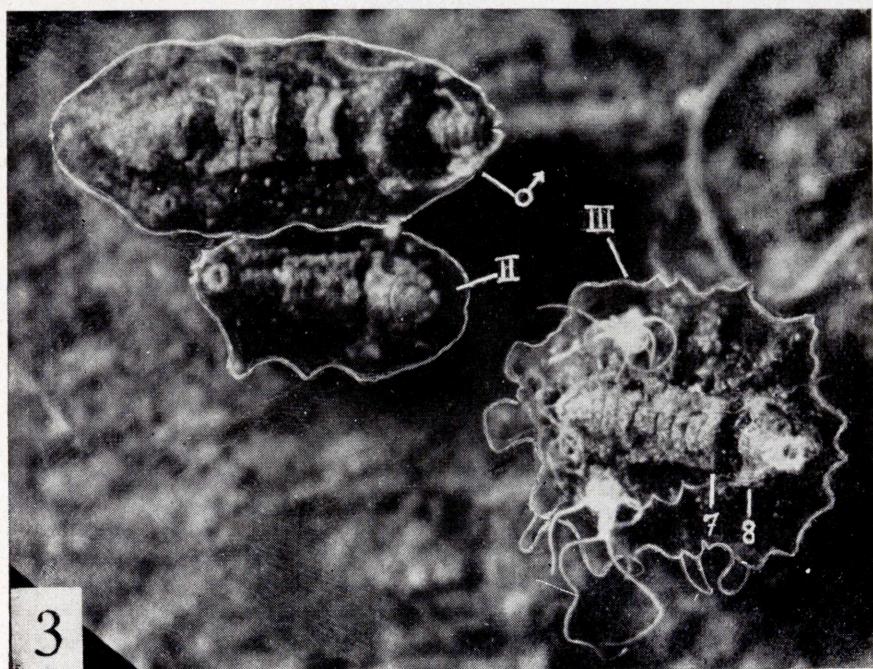
Fig. 16.—*L. communis*, on *P. dulce*, as in fig. 15. The dorsal surface shows elliptical, claw-like markings, the relics of 3rd stage. The circular wall is now one layered; fig. 16 is to be compared with figs. 14 and 15.





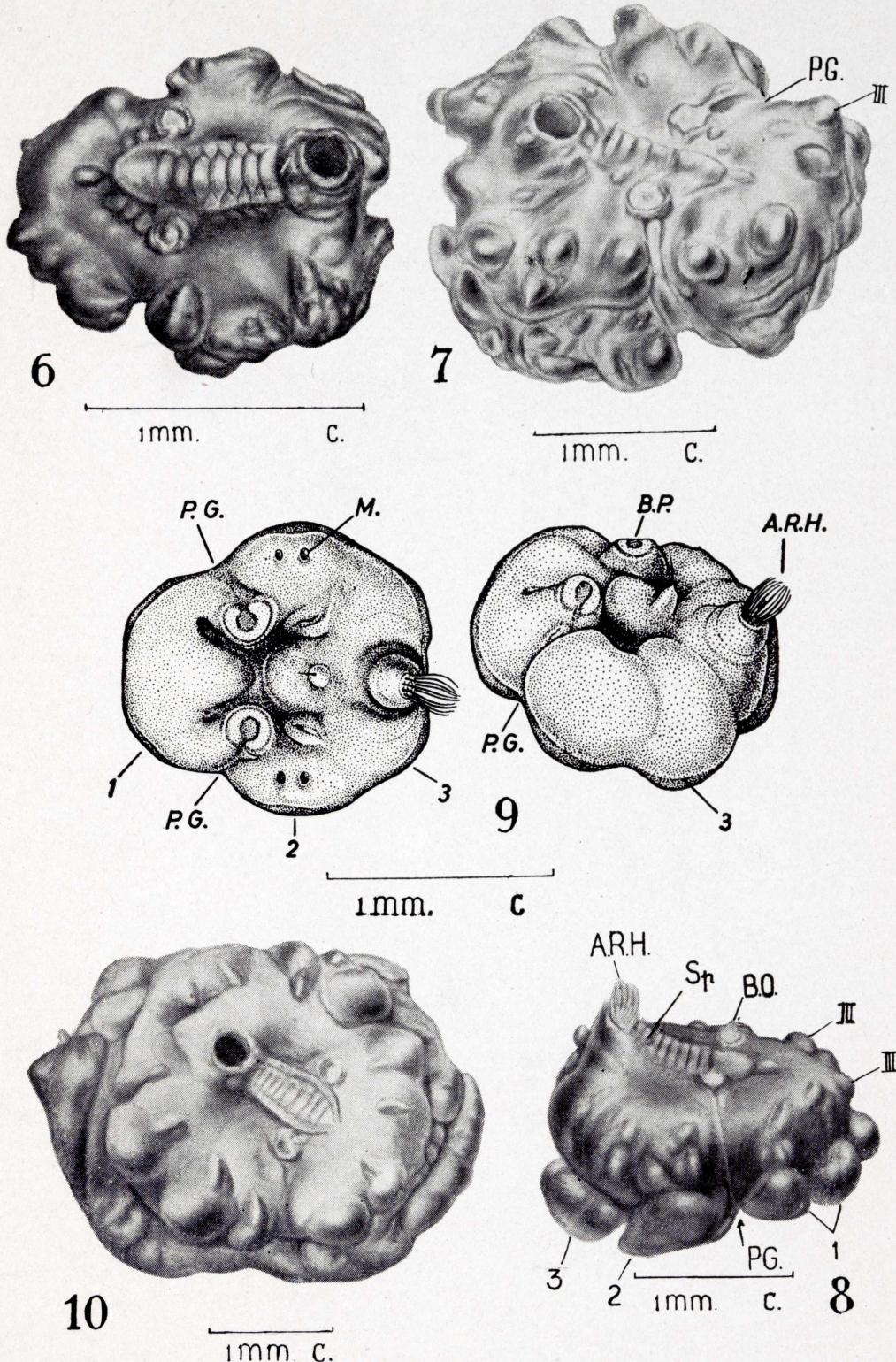
S. MAHDIHASSAN: The development of the adult female lac cell.





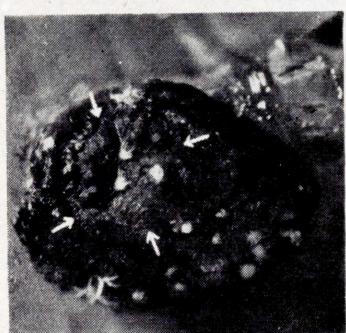
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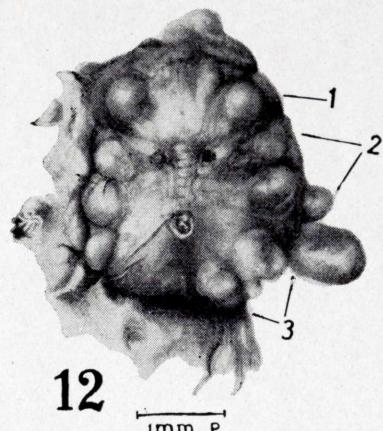


S. MAHDIHASSAN: The development of the adult female lac cell.

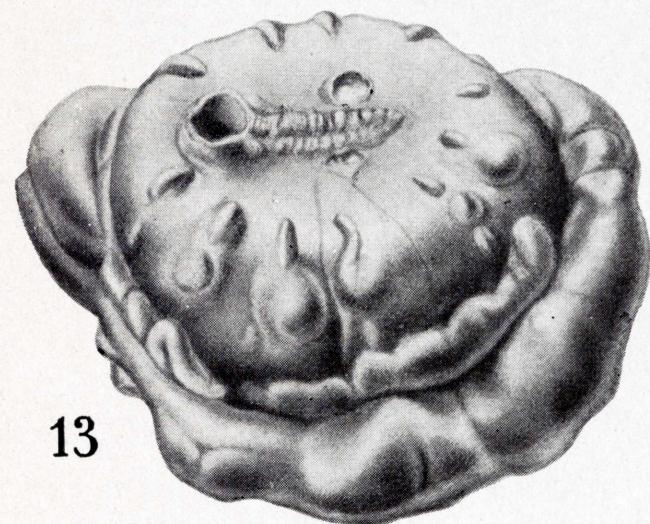




11



12

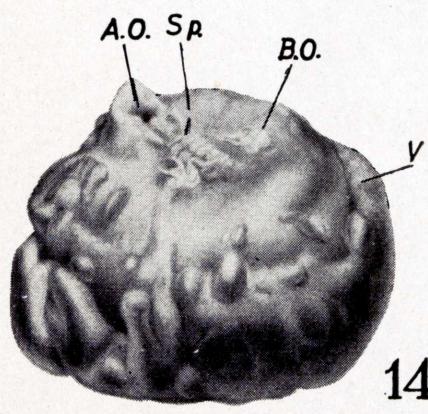


13



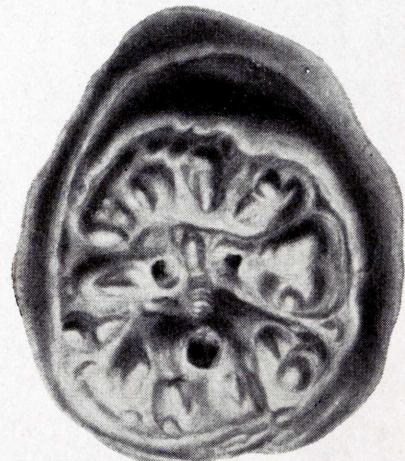
16

1mm C.



14

1mm. C.



15

1mm. C.

